

WHAT IS CLAIMED IS:

1. A flat panel X-ray detector which comprises:  
an X-ray-charge conversion film converting  
incident X-rays into electric charges; and

5 a pair of electrodes disposed in contact with both  
surfaces of said X-ray-charge conversion film;

wherein said X-ray-charge conversion film has a  
laminate structure including a plurality of metal  
halide films laminated along direction of c-axis of  
10 hexagonal crystal structure and differing in band gap  
from one another, and halogen atoms contained in said  
plurality of metal halide films are of the same kind  
among them.

2. The flat panel X-ray detector according to  
15 claim 1, wherein at least one of said pair of  
electrodes is a conductive film which is lattice-  
matched with said metal halide film disposed  
neighboring thereon.

3. The flat panel X-ray detector according to  
20 claim 1, wherein said metal halide film comprises at  
least one metal halide selected from the group  
consisting of metal iodide, metal bromide and metal  
chloride, said metal being selected from the group  
consisting of Pb, Hg, Sn, Bi, In, Tl, and Cd.

25 4. The flat panel X-ray detector according to  
claim 1, wherein said metal halide film comprises at  
least one metal halide selected from the group

consisting of  $\text{PbI}_2$ ,  $\text{HgI}_2$ ,  $\text{SnI}_2$ ,  $\text{BiI}_3$ ,  $\text{InI}$ ,  $\text{InI}_3$ ,  $\text{CdTe}$ , and  $\text{TlI}$ .

5        5. The flat panel X-ray detector according to  
claim 1, wherein said metal halide film comprises at  
least one metal halide selected from the group  
consisting of  $\text{PbI}_2$ ,  $\text{HgI}_2$ ,  $\text{SnI}_2$ ,  $\text{BiI}_3$ ,  $\text{InI}$  and  $\text{InI}_3$ ;  
said electrodes comprises a hexagonal crystal structure  
having a-axis lattice constant of 4.5 angstroms, a  
face-centered cubic structure having a-axis lattice  
10       constant of 6.45 angstroms or a body-centered cubic  
structure having a-axis lattice constant of 4.27  
angstroms; and lattice mismatching between at least one  
of said electrodes and said metal halide film disposed  
neighboring thereon is 20% or less.

15       6. The flat panel X-ray detector according to  
claim 1, wherein said plurality of metal halide films  
comprise metal halides which are the same in kind with  
one another but differ in conductivity type from one  
another.

20       7. The flat panel X-ray detector according to  
claim 6, wherein said plurality of metal halide films  
comprise an n-type metal halide film and a p-type metal  
halide film.

25       8. The flat panel X-ray detector according to  
claim 7, wherein said plurality of metal halide films  
comprise a Bi-doped n-type  $\text{PbI}_2$  film and an In-doped p-  
type  $\text{PbI}_2$  film.

9. The flat panel X-ray detector according to claim 6, wherein said plurality of metal halide films comprise an n-type metal halide film, an i-type metal halide film and a p-type metal halide film.

5           10. The flat panel X-ray detector according to claim 9, wherein said plurality of metal halide films comprise a Bi-doped n-type  $\text{PbI}_2$  film, an undoped  $\text{PbI}_2$  film and an In-doped p-type  $\text{PbI}_2$  film.

10           11. The flat panel X-ray detector according to claim 1, wherein said plurality of metal halide films comprise mixed crystalline metal halides which are the same in kind with one another but additionally contain different kinds of metal elements therein.

15           12. The flat panel X-ray detector according to claim 11, wherein said plurality of metal halide films comprise a  $\text{Pb}_x\text{B}_y\text{I}$  film, a  $\text{PbI}_2$  film and a  $\text{Pb}_x\text{In}_y\text{I}$  film.

          13. The flat panel X-ray detector according to claim 1, wherein said plurality of metal halide films comprise various kinds of metal halides.

20           14. The flat panel X-ray detector according to claim 13, wherein said plurality of metal halide films comprise a  $\text{BiI}_3$  film, a  $\text{PbI}_2$  film and an  $\text{InI}_3$  film.

          15. The flat panel X-ray detector according to claim 1, wherein at least one of said electrodes  
25           comprise a hexagonal crystal structure having a-axis which is approximately equivalent to (0001), a face-centered cubic structure having a-axis which is

approximately equivalent to (111) or a body-centered cubic structure having a-axis which is approximately equivalent to (110).

16. A flat panel X-ray detector which comprises:

5        an X-ray-charge conversion film converting incident X-rays into electric charge;

      pixel electrodes formed on said X-ray-charge conversion film to correspond with each of pixels which are arranged in a form of array;

10       switching elements each electrically connected with each of said pixel electrodes;

      signal lines each electrically connected with said switching element of each row;

15       scanning lines each electrically connected with said switching element of each column; and

      a common electrode which is disposed on one of the surfaces of said X-ray-charge conversion film, which is opposite to the surface where said pixel electrodes of said X-ray-charge conversion film are disposed;

20       wherein said X-ray-charge conversion film has a laminate structure comprising a plurality of metal halide films laminated along a direction of c-axis of hexagonal crystal structure and differing in band gap from one another, the halogen atoms of the metal halide  
25       films are of the same kind with one another.

17. The flat panel X-ray detector according to claim 16, wherein said plurality of metal halide films

comprise a Bi-doped n-type  $\text{PbI}_2$  film, an undoped  $\text{PbI}_2$  film and an In-doped p-type  $\text{PbI}_2$  film.

18. The flat panel X-ray detector according to claim 16, wherein said plurality of metal halide films  
5 comprise a  $\text{Pb}_x\text{B}_y\text{I}$  film, a  $\text{PbI}_2$  film and a  $\text{Pb}_x\text{In}_y\text{I}$  film.

19. The flat panel X-ray detector according to claim 16, wherein said plurality of metal halide films comprise a  $\text{BiI}_3$  film, a  $\text{PbI}_2$  film and an  $\text{InI}_3$  film.

20. The flat panel X-ray detector according to  
10 claim 16, wherein at least one of said pair of electrodes is a conductive film which is lattice-matched with said metal halide film disposed neighboring thereon.